LESSON: Stop that Sediment

Grade Range	4th
Target Grade	4th
Duration	45-60 minutes
Location	Classroom

Objectives:

Stop that Sediment is designed as a post-field trip activity where students will:

- Learn about the process of and the hazard associated with excessive sedimentation in the Toutle, Cowlitz, and Columbia Rivers;
- Learn about the real-life projects engineered to mitigate this hazard, such as the Sediment Retention Structure;
- Design their own engineering solution to the excess sedimentation problem;
- Prepare a report to explain and elaborate their solution;
- Share, discuss, and evaluate designs with class or in small teams.

Outcomes:

4-ESS3-2: Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

Learning Experience:

Students work individually or in teams to design a solution to mitigate the ongoing hazard of excessive sedimentation in the Toutle River Valley and connected basins. Teacher provides an engaging introductory PowerPoint lesson. Students sketch and/or write their plans for their solution. Students share, discuss, and evaluate their designs with the class or in small teams.

Materials:

- PowerPoint presentation
- Student worksheet packet

Next Generation Science Standards:

Dimension from Framework	Connections to the 3 Dimensions
Science and Engineering Practice: • **Constructing Explanations and Designing Solutions**	Students **explain** in their own words why excessive sedimentation is potentially harmful and **design** their own **solution** to mitigate this hazard.
Disciplinary Core Ideas: • **ESS3:B** Natural Hazards	Students understand that not all **volcanic hazards** happen during eruptions. Ongoing, long-term sedimentation is a natural hazard that is difficult, if not impossible to stop. However, humans can **reduce the impacts of** (or mitigate) this hazard.

Crosscutting Concepts: • **Systems and Systems Models**	Students design and itemize the supplies and/or services needed for their design. In describing their **model**, they must also describe why they think their **system** will be the most effective for mitigating the hazard of excess sedimentation.

Common Core State Standards:

Common Core State Standard (CCSS)	Connections to CCSS
ELA	NA at this time
Math	NA at this time

Background:

The 1980 eruption began with an enormous landslide. This landslide was the largest landslide that was witnessed by people in recorded human history. The amount of rock that came down in the landslide could fill a million Olympic-sized swimming pools.

The landslide traveled down the Toutle River Valley for 14 miles, forming big mounds of sediment called hummocks. Essentially, the side (X% of the original mountain) of Mount St. Helens ended up in the Toutle River Valley as pieces of rock.

Sediment is a word for a piece of rock that has been moved from where it originally was, usually by water. Sand is a type of sediment. Sediment can also be smaller (like the size of powdered sugar) or bigger (like pebbles, cobbles, and boulders).

Not all of the sediment from the landslide remained where in the upper Toutle River Valley. A few hours after the eruption, the sediment mixed with water and created a dangerous lahar (or volcanic mudflow) that ripped up buildings, trees, and bridges.

The lahars in the 1980 eruption were devastating. They ripped up trees, buildings, bridges, and more. The amount of sediment that was carried along in this devastating lahar could fill about 10,000 Olympic-sized swimming pools. That sounds like a lot, but that means there was still enough sediment near the volcano to fill 990,000 Olympic pools after the enormous, destructive lahar.

The Toutle River continues to carry more sediment from the hummocks downstream. Even when the river seems calm, the Toutle River carries enough sediment to fill about 3000 pools per year. This sediment can fill in river channels, and bury roads, businesses, and houses.

Almost 90% of the sediment from the landslide is still in the hummocks near the volcano, waiting to be carried downstream by the Toutle River. This huge amount of sediment may cause problems for the people that work, live, and play by the river for many years to come. This is where you come in – we need your help to fix it!

Challenge:

Design a plan to minimize the effect of ongoing sedimentation in the Toutle River Valley for the next 50 years. This can include building a structure, using natural resources (such as trees or logs) to

slow or stop sediment, using services (like digging or dredging) to get rid of sedimentation, some combination of the three, or an entirely different, creative idea!

Instructional Sequence:

ENGAGE

1. Start the PowerPoint presentation which explains the process and hazards of excess sedimentation in the Toutle River Valley. Ask:

> Why is excess sedimentation a problem for the people that work, play, and live in the valley? If nothing is done to slow or stop the amount of sediment that travels downvalley, what kinds of problems do you think the sediment could cause?

2. Continue the PowerPoint presentation which describes a real-life engineering solution to this problem: the Sediment Retention Structure.

3. Continue the PowerPoint presentation and present the students with the challenge. This activity is somewhat like Minecraft on paper. Emphasize that they are encouraged to be creative with their engineering solutions and their solution can be a combination of multiple things (like building a structure AND paying for dredging services).

4. Give each student a worksheet packet. Continue the PowerPoint to show students an example and to discuss design considerations such as:

- If the students are building a structure, should it be a dam or levee?
- How big should the structure be? How wide, how tall, and how thick?
- How many structures does the student want to build?
- Dam-like structures should have a way for water to flow through.
- Do you want to dredge the sediment?
- Do you want to drill a big hole into something?

5. While showing students the example, explain the "budget" that is in the worksheet packet.

- Student designs must cost no more than the allocated "budget" of 200 coins.
- The supplies are priced by block. The students can "cut" a block into any shape they want. Students must count the total number of blocks that they use in order to calculate how many coins their project costs.
- Explain to students that they are welcome to use other supplies or services not listed on this sheet! However, they must explain the idea to the teacher who must let the student know the cost of the supplies. They will then add the cost to the bottom of their table.

EXPLORE

6. Ask the students to begin designing their solution. They can work individually or in small groups. Remind student to count the number of blocks and keep track of the amount of coins they are spending.

EXPLAIN & ELABORATE

7. Once students have decided and planned their solution, they must complete the "report" in the worksheet packet to explain and elaborate on their design.

EVALUATE

8. Once everyone has completed their design plans and report, students will share, discuss, and evaluate their designs with class or in small teams. Ask the students to evaluate their designs based on one or more of the following:

- What are the strengths and weaknesses of each design?
- How does each design withstand: (in other words, how does each design hold up against…)
    - an earthquake;
    - another eruption;
    - another lahar;
    - and/or more than 50 years of sediment transport?